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**How Do Firms Develop the Organizational Capability to Mobilize
and Create Knowledge for Innovation?:
A Theoretical Framework***

by
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How Do Firms Develop the Organizational Capability to Mobilize and Create Knowledge for Innovation?: A Theoretical Framework

Abstract

This paper integrates three streams of literature –organizational capabilities based in RBV and the team-level and organization-level innovation– to provide a theoretical framework of how firms invest in developing capabilities. The “organization model” requires firms to invest at the organization level to generate the supporting organization-level processes, i.e., communication routines, independent of when they organize for innovation, and the “project team model” calls for just-in-time investment as needed in the process of innovation. [73]

Key words: Capability development models, Knowledge, and Innovation

Organizational capabilities to mobilize and create knowledge for innovation are critical for competitive advantage, however, we still do not have a theoretical framework of how to develop them. These capabilities have been discussed as “dynamic capability” (Teece, Pisano, and Shuen, 1997), “core capability” (Leonard-Barton, 1995), “combinative capability” (Kogut and Zander, 1992), “core competence” (Prahalad and Hamel, 1990), and “integrative capability” (Lawrence and Lorsch, 1967), and these authors consider them as key for competition. However, despite the extensive debate about its importance, there is still limited understanding of “how” organizations invest in developing them. As Foss, Knudsen, and Montgomery (1995) indicate: “The question of intentionality becomes particularly salient when considering how a firm sets out to build a given set of capabilities. Because resources that support a competitive advantage are by definition inimitable, and unidentifiability is a sufficient condition for inimitability, it is difficult to say how one should invest to build a competitive advantage. On the other hand, the view that one cannot make such investments purposively is not satisfactory either. Is there a way out of this conundrum?” (p. 13).

In this paper I present a critical analysis of three bodies of literature which can be integrated to provide a framework for how organizational capabilities are developed: the literature on organizational capabilities based in the resource-based view of the firm (RBV), that based in the team-level innovation literature, and that based in the organization-level innovation literature. First, I discuss each body of literature independently, in order to draw on its insights and assess its limitations. I then integrate them, thus providing a better understanding of processes and management practices that support the development of the capabilities to integrate, mobilize and create knowledge for innovation.

PERSPECTIVES ON ORGANIZATIONAL CAPABILITIES IN THE RBV

The literature on organizational capabilities has its roots in the RBV, whose main argument is that a firm is a bundle of heterogeneous resources and capabilities, which supports competitive advantage and explains the variance in performance across companies. However, as Foss (1997: 346) pointed out, one of the main problems with this theory is that there is a considerable amount of “terminological soup” for capabilities, with various resource-based theorists using concepts such as “resources”, “competencies”, “capabilities”, “assets,” etc., to capture essentially the same concept. Therefore, before I discuss what I mean by organizational capabilities, it is necessary to provide some key definitions found in the literature.

Definitions of organizational capabilities

Organizational capabilities concern an organization’s ability to combine different types of resources, especially firm-specific knowledge embodied in their employees, in order to create new resources that enable firms to achieve and sustain their competitive advantage. Organizational capabilities are viewed as a type of strategic resource (Foss, 1997; Foss et al., 1995), because they are rare, valuable, inimitable, non-tradable, and non-substitutable (Barney, 1991). In this study, I focus on the organizational capabilities of mobilizing and creating knowledge for innovation. These capabilities are specified as a firm’s ability to mobilize knowledge, and combine and convert individual knowledge embedded in different disciplines for creation of new knowledge that results in innovation in products and/or processes. Moreover, these capabilities are dynamic in that they involve the interaction and changes between firm’s internal knowledge and the demands of the external market (Helfat and Raubitschek, 2000). In other words, it involves the continuous integration and combination of knowledge from the external market with the internal knowledge and capabilities of the firm, such that the demands

of the external market are constantly met. Some related concepts of organizational capabilities are: “productive services” (Penrose, 1959), “organizational routines” (Nelson and Winter, 1982; Winter, 2000), “core competence” (Prahalad and Hamel, 1990), “combinative capability” (Kogut and Zander, 1992), and “dynamic capability” (Teece et al., 1997).

The capability to mobilize knowledge

Researchers who focus on organizational capabilities and are based in the RBV tend to discuss knowledge mobilization and assume that knowledge creation follows directly from such mobilization. Moreover, when discussing organizational capabilities, these researchers (e.g., Nelson and Winter, 1982; Prahalad and Hamel, 1990; Kogut and Zander, 1992; Hamel, 1994) choose to focus exclusively on firm-specific knowledge and skills of their personnel, especially their tacit knowledge (Nonaka, 1994; Spencer, 1996). The main reason is that firm-specific tacit knowledge embodied in these human resources is rare, valuable, inimitable, non-tradable, and non-substitutable, and therefore enables firms to achieve sustainable competitive advantage (Winter, 1995; Grant, 1996; Liebeskind, 1996) and rents associated with it (Peteraf, 1993). Nelson and Winter (1982), for instance, argue that the differences in firms’ performance are explained by the differences in their routines, which embody individual knowledge and skills. Some organizations have routines that are conducive to knowledge mobilization and creation that enable them to expand or maintain their competitive advantage. The authors also argue that this capability is a source of competitive advantage and sustainability, because the way in which routines are developed is difficult to observe and causally ambiguous. Moreover, these routines are built over time as a result of a firm’s strategies and structures, which evolve over time and are path-dependent. It is the persistence of these routines that enables firms to enjoy superior

performance and at the same time makes it difficult for competitors to catch up (Teece et al., 1997).

Prahalad and Hamel's (1990) core competence is contingent on the firm's ability to mobilize and combine individual knowledge and skills across boundaries to create new resources, i.e., innovation. This ability enables a firm to expand or sustain its competitive position. Therefore, the way in which these human resources are managed is critical in developing or possessing this capability. Similarly, Kogut and Zander (1992) argue that the firm's combinative capability is a more promising source of competitive advantage, because it depends on the social relations within small groups of individuals who share and combine their knowledge to create new resources. Leonard-Barton (1995) and Nonaka and Takeuchi (1995) also discuss knowledge sharing across individuals as critical in having this capability. What is implicit in these discussions is that the capability to mobilize knowledge includes the integrative or combinative capability of knowledge from the external markets with the internal environment of the firm, and these processes themselves safeguard a firm's sources of sustainable competitive advantage.

Although these authors take a more dynamic approach to understanding resources in competition¹, particularly the way in which individual knowledge is mobilized and combined to

¹ In contrast to the static approach that views individual or groups of resources as the sources of rents either through acquisition or protection of critical resources that firms already own (Wernerfelt, 1984; Rumelt, 1982; Barney, 1986; Baumol et al., 1987; Spence, 1981; Stigler, 1968; Bain, 1956), the dynamic approach tries to explain how new resources are generated.

create new resources, the understanding of how these resources are created is limited if one does not discuss the creation processes² (Wernerfelt, 1997).

The capability to create new knowledge

While researchers analyzing organizational capabilities tend to emphasize the knowledge mobilization process and assume creation occurs, a few researchers examine the processes of knowledge creation (Leonard-Barton, 1995; and Nonaka and Takeuchi, 1995). Nonaka and Takeuchi (1995) provide a comprehensive model of the way in which new resources are created in organizations. Their model includes individual knowledge mobilization, combination, and conversion into organizational resources. The model involves two main processes, the mobilization of individual knowledge and the conversion of individual knowledge into organizational knowledge that comes in the form of innovations, which is considered to be a new resource to the firm. The basic argument behind Nonaka and Takeuchi's (1995) knowledge creation model is that knowledge mobilization and creation are difficult, not because of individuals' lack of motivation to share their knowledge, but because the nature of individual tacit knowledge constrains knowledge mobilization and conversion.

According to this model, knowledge mobilization is a necessary but insufficient condition for new resource creation. The initial step in the knowledge creation process is the "socialization" process whereby individual knowledge is mobilized or shared with other individuals. Because of the tacitness of individual knowledge, the sharing process requires the sharing of individual experiences through observation or imitation rather than documentation or articulation. The second step involves a process of "externalization" whereby individual tacit knowledge is made explicit to the receiver through the use of analogies, metaphors, hypotheses,

² With the exception of Leonard-Barton (1995) and Nonaka and Takeuchi (1995).

concepts, or models (p. 64). There is then a “combination” process whereby individual explicit knowledge is shared between a group of individuals through the use of different media such as phone conversations, meetings and computer-aided media (p. 67). The final process is “internalization”, whereby individuals internalize or absorb new knowledge from the socialization, externalization, and combination processes. This process is basically ‘learning by doing’, through interaction with other people in the process of creating new resources. All of these processes are interactive and work together in a spiral fashion. The ability of different firms to mobilize individual knowledge and convert it into organizational knowledge varies, and it is arguable that this difference in ability explains the differences in firms’ ability to generate innovations, and therefore, their overall performance. Moreover, this capability is protected from being appropriated away by competitors because the processes underlying the capability are difficult to observe and therefore difficult to imitate.

Leonard-Barton’s model of knowledge creation for innovation is viewed as a shared problem-solving activity (1995: p. 61; Leonard and Sensiper, 1998). By putting the creation process under a microscope, the author suggests that the facilitators of knowledge creation are more than just incentives (Teece et al., 1997). For example, some of the barriers to shared problem-solving are the individual-level trap mind-set of organizational success, their signature or highly specialized skills, the lack of differences between individual cognitive styles or mental models, and different preferences in tools and methodologies. However, without empirically and systematically testing and analyzing what companies do and the factors and management practices that facilitate knowledge mobilization and creation, we still do not know how this capability is developed. On one hand, researchers who focus on the knowledge mobilization process suggest that communication patterns or routines and cooperation are critical for

organizational capability, and rewards and/or building social ties facilitate their development. On the other hand, researchers who focus on the creation process suggest that the overlapping knowledge is crucial (Leonard-Barton, 1995; Nonaka, 1994), which has strong implications for human resources development in different parts of the organization. For example, Leonard-Barton (1995) suggests that both sets of factors are necessary; however, overlapping knowledge in organizations is limited (p.76).

Limitations of the organizational capabilities literature

The literature on organizational capabilities rooted in the RBV has several limitations in dealing with (1) the treatment of knowledge mobilization vs. creation, (2) level and unit of analysis, (3) measurement, and (4) theoretical framework of how to develop them.

First, by focusing on knowledge mobilization or on creation we cannot fully understand the processes of new knowledge creation in organization. Moreover, making the distinction and analyzing them separately leads to different implications regarding the development of the organizational capabilities. On one hand, mobilization is supported by incentives (Teece et al., 1997) or social ties (Kogut and Zander, 1992). On the other hand, creation is supported by overlapping knowledge. Since knowledge mobilization seems to be a necessary but insufficient condition for new knowledge creation, the mobilization and creation processes need to be analyzed together in order to determine the factors that facilitate these processes.

Second, the organizational capabilities literature deals with the organization-level of analysis; however, its unit of analysis is clearly the project team. Project teams are mechanisms for knowledge mobilization and conversion into organizational knowledge. Therefore, organizational capability theorists suggest that the main driver behind this capability is how well small groups of carriers of core competence or project teams can effectively mobilize and

convert their individual knowledge into organizational knowledge in the form of product and/or process innovation (Prahalad and Hamel, 1990). Kogut and Zander (1992) also stress the importance of communication or knowledge sharing among small groups of individuals in developing combinative capability. Teece et al. (1997) suggest that one of the main determinants of the dynamic capability is the willingness of groups to share knowledge in order to create the innovation. In the knowledge creation model (Nonaka and Takeuchi, 1995), the level of analysis is clearly the company; however, the unit of analysis is explicitly the project team organized to create new knowledge for innovation. Leonard-Barton (1995) also discusses the core capability at the company level (business unit), but her unit of analysis is clearly a team consisting of members coming together to develop new products.

Third, one of the greatest limitations is the lack of measurement for organizational capability. Godfrey and Hill (1995) suggest that organizational capability is an intangible that is not measurable directly, but only by its outcomes. The use of patent counts (Henderson and Cockburn, 1994) is an objective measure. However, as Foss et al. (1995) pointed out, organizational capability is a process phenomenon dealing with knowledge mobilization (Nelson and Winter, 1982; Kogut and Zander, 1992) and creation (Leonard-Barton, 1995; Nonaka and Takeuchi, 1995). Therefore, patents do not capture these processes and other outcomes of this capability, e.g., speed-to-market of the innovation and the success of that innovation in meeting the demands of the market, which are also important for competitive advantage (Teece et al., 1997; Helfat and Raubitschek, 2000). Moreover, some studies (e.g. Griliches, 1984) found that outside the chemical and agricultural industries, patents are not regarded as essential by innovators.

Fourth, the most critical limitation in understanding this phenomenon is the lack of framework of key factors and management practices that explain how firms can develop it (Foss et al., 1995). Researchers analyzing knowledge mobilization suggest that incentives (Prahalad and Hamel, 1990; Teece et al., 1997) and the building of social ties (Kogut and Zander, 1992) facilitate the process. However, they do not offer explanations of what types of rewards would do this, or how a company would build these social ties. Prahalad and Hamel (1990), for instance, suggest that firms that have core competencies manage their employees such that there is a shared sense of cooperation in achieving organizational goals and communication patterns that transcend functional and business boundaries. They view firms that have core competencies as firms that induce their employees to share or mobilize knowledge and expertise across boundaries to generate innovations. In firms that lack such core competencies, each part of the organization views other parts as rivals. Therefore, knowledge mobilization is limited since the different parts of the organization hide critical knowledge from one another rather than sharing it to create new resources. Kogut and Zander (1992) suggest that “organizing principles” facilitate the development of this capability by facilitating communication and cooperation. However, it is unclear what these organizing principles are.

Moreover, Nelson and Winter (1982) and Teece et al. (1997) suggest that cross-functional communication routines are important factors in possessing this capability. Similar to the previous researchers, they do not clarify the way in which these routines are established. Leonard-Barton (1995) argues that one of the key dimensions in developing this core capability is having the values and norms that encourage knowledge sharing and cooperation. Organizations that have this core capability value cooperation, trust, and the routines of working together to share knowledge in order to create new knowledge for innovation (p. 48). However,

we do not know how these supporting routines are developed. In contrast to other researchers, Leonard-Barton (1995) suggests the use of selection and reward to induce knowledge sharing. She argues that selecting employees based partly on personality traits conducive to collaboration and rewarding them partly based on team performance encourages cooperation and knowledge sharing (p. 14).

Fortunately, we can turn to the team-level innovation and organization-level innovation literatures to better understand the processes and management practices that facilitate innovation. These bodies of literature help to explain how the capability to mobilize and create knowledge for innovation is developed; after all, they are also about new knowledge creation and innovation, although they do not discuss their processes and outcomes in terms of capabilities. Another advantage of linking these bodies of literature to the organizational capability literature is that they provide empirical support for some of the processes and management practices that facilitate innovation.

PERSPECTIVES FROM TEAM-LEVEL INNOVATION LITERATURE

There exists an extensive body of literature that focuses on the project team-level of analysis, where employees form project teams for the purpose of mobilizing knowledge and creating new knowledge for innovation. This field of research recognizes the importance of organizational context (e.g. Gladstein, 1984; Ancona and Caldwell, 1992b; Hackman, 1986; 1990; Denison, Hart, and Kahn, 1996). However, the focus is still on the project team-level processes, project team management practices, and their outcomes. Similar to the literature on organizational capabilities, this body of literature also stresses the importance of communication

and cooperation as facilitators of knowledge mobilization. Studies that focus on the creation process suggest that overlapping knowledge among members enhances the process.

Project-team processes and innovation

Project team-level processes can be divided into two groups: those that facilitate knowledge mobilization and those that facilitate the creation process. While communication and cooperation facilitate knowledge mobilization, overlapping knowledge among team members facilitates the creation process. Communication and cooperation do not support the knowledge creation process, because individuals are boundedly rational, and therefore, do not have the ability to absorb different types of knowledge being communicated or mobilized and transform it into new knowledge.

Project team-level communication. The traditional approach to studying team-level innovation considers communication as the key factor in generating the innovation. At the project-team level, communication is divided into two types: internal communication, which occurs among team members, and external communication, which occurs between team members and their external links. Both types of communication are considered critical for innovation, since communication is assumed to be an exchange of knowledge among individuals involved. Since communication is viewed as an exchange of knowledge or resources, the higher the frequency, the more knowledge is being exchanged, and the better this is for innovation (Dougherty, 1987; Griffin and Hauser, 1992; Allen, 1977).

Empirically, successful innovation has been shown to require communication between R&D, engineering, and marketing to combine technological capabilities and constraints (Souder, 1987; Katz, 1982). Dougherty (1987), for instance, suggests that projects with unsuccessful

outcomes typically had lower levels of communication frequency, while successful projects were those that had a higher frequency of interfunctional communication.

Project team-level shared sense of cooperation. A shared sense of cooperation among team members is also proposed to enhance teamwork performance in the process of innovation (Cannon-Bowers and Salas, 1990; Wageman and Baker, 1997). There are numerous definitions for this concept ranging from “group mind”, and teamwork schemas to common cause maps (Klimoski and Mohammed, 1994: 403). In this paper, project team shared sense of cooperation is defined as a team-shared goal and commitment to accomplishing the team task (Gladstein, 1984; Katz, 1997:138). A shared sense of cooperation enhances innovation, since it motivates knowledge exchange (Madhavan and Grover, 1998).

Project-team overlapping knowledge. While communication and cooperation facilitate knowledge mobilization, researchers who emphasize the creation process suggest that overlapping knowledge among team members supports the creation process of new knowledge for innovation. Project team overlapping knowledge is the common knowledge that team members have, which enables individuals to take the perspective of other team members in the process of exchanging knowledge for innovation (Boland and Tenkasi, 1996). Additionally, the overlapping can be understood in terms of the absorptive capacity that individuals have for other types of knowledge present within the team. Overlapping knowledge facilitates the conversion and integration of different types of knowledge to create and achieve innovation (Madhavan and Grover, 1998). The underlying logic is that overlapping knowledge provides team members with the cognitive resources to combine insights synergistically from multiple knowledge sets (Madhavan and Grover, 1998).

Project-team management practices and innovation

Project team management practices are divided into two groups. The first facilitates knowledge mobilization, and the second facilitates the creation process. Those who analyze the mobilization process and assume that creation occurs often imply that the motivation to share knowledge is critical. Therefore, rewards for team performance (Ancona and Caldwell, 1999) and team development (Roth and Kleiner, 1996) encourage communication and cooperation. Researchers who focus more on the creation process stress the importance of team membership selection to ensure overlapping knowledge among members (Madhavan and Grover, 1998).

Project team-level reward. Previous studies suggest that rewards at the level of the project team affect project team performance (e.g. Katz and Allen, 1985; Gladstein, 1984). While some researchers (e.g. Katz and Allen, 1985) suggest that job assignments and promotion impact the process of innovation, other researchers suggest that both monetary and non-monetary rewards have impact on innovation (Roberts and Fusfeld, 1982). When individuals believe that their contributions on project teams towards achieving the goals of the projects are rewarded, they are likely to perform in such a way that they enhance project team performance (Milgrom and Roberts, 1992; Lawler, 1994). Empirically, reward for team performance has a positive impact on its outcome (Ichniowski, Prennushi, and Shaw, 1997; Wageman, 1995). Therefore, project teams that receive rewards for their project team performance are likely to perform better than those that do not receive such rewards.

Project team-level development. Project team development is related to team building, a process of taking a collection of individuals with different needs, backgrounds, and expertise, and transforming them into an integrated, effective work unit (Thamhain and Wilemon, 1997). Project team development, which entails teaching team members about the goals of the projects

and the processes by which they can be achieved, enhances their performance (Hershock et al., 1994). The underlying idea behind project team development is that members represent different “thought worlds” (Dougherty, 1992), with different objectives and expertise; individually they attempt to reduce uncertainty about their roles within the group. They seek to enact (Weick, 1995) their environments on their project team by directing their activities toward the establishment of a workable level of certainty and clarity in carrying out this team task. Training on how to manage these processes enables individuals to develop their own situational perspective and therefore work more effectively. A critical factor behind project team development is the interaction among key individuals who are expected to work together to accomplish the project. This development process may require the team leader (Clark and Wheelwright, 1992) to teach members how to organize work processes and how to better communicate with members from outside their “thought worlds” or subcultures (Schein, 1996) within the organization.

Project team-level membership selection. For overlapping knowledge, project team membership selection based on some overlapping knowledge among team members is critical (Madhavan and Grover, 1998). Madhavan and Grover (1998) argue that selection based on these factors is critical because individuals with overlapping knowledge would have the ability to absorb the knowledge being shared, combine it, and convert it into new knowledge. However, this overlapping knowledge is rare in organizations, and thus does not occur automatically on project teams, since the pool of human resources in the organization contains different knowledge sets, most of which do not have overlapping knowledge (Leonard-Barton, 1995).

mobilization between design and manufacturing are necessary. Dougherty (1992) also suggests that new product development is contingent on the communication frequency among individuals in the sales/marketing, R&D, and manufacturing functions.

Organization-level shared sense of cooperation. This body of literature also suggests that knowledge mobilization is facilitated by cross-functional cooperation. Depending on the organization, individuals in different functions view other functions as coalitions of interests (Cyert and March, 1963) or as a cooperative system (Barnard, 1938). Cross-functional cooperation embodies the organization-shared vision (Prahalad and Hamel, 1990) and commitment (Lincoln and Kalleberg, 1990). Therefore, cross-functional cooperation not only embodies the collective goals and aspirations of organization members (Tsai and Ghoshal, 1998), but also their understanding of how knowledge embedded in different disciplines connects when necessary to create new resources. The common vision and commitment help organization members to see the potential value of their knowledge mobilization.

Organization-level overlapping knowledge. Organizational slack is also important for innovation (Nohria and Gulati, 1995), which in this paper takes the form of overlapping knowledge. Nohria and Gulati (1995) define slack as the pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output. Some examples of slack resources are redundant employees, unused capacity, and unnecessary capital expenditures. By this definition, overlapping knowledge that supports knowledge creation for innovation is a type of slack resource. According to Nonaka (1994)³ another name for

³ Nonaka's unit of analysis is the project team, however, his idea of overlapping knowledge among team members has implication about the stock of overlapping knowledge available at the organization regardless of when it is used.

overlapping knowledge is redundant knowledge, which, by definition, is knowledge that is unnecessarily repetitive or superfluous. To be clear, however, overlapping knowledge in this study deals with the overlapping disciplinary knowledge in the organization. Despite the lack of empirical tests, the argument for overlapping knowledge sets is that they provide individuals with the cognitive capability and absorptive capacity to combine insights synergistically, effectively and efficiently from multiple knowledge sets for innovation. Since each function or community of practice (Brown and Duguid, 1991) has its own “thought world” where knowledge is embedded, the overlapping knowledge in other functions enables individuals to take the perspective of other functions during the process of knowledge exchange with members of those functions in the process of innovation (Boland and Tenkasi, 1996). Individuals with overlapping knowledge of other functions possess absorptive capacity for receiving knowledge from other functions, since their overlapping knowledge enables them to take the perspective of those functions when combining knowledge with their own function in the process of innovation (Boland and Tenkasi, 1996).

Organization-level management practices and innovation

Researchers who focus on knowledge mobilization suggest that organizational design is based on the way in which employees are managed generate these organization-level processes. The organization design that fosters innovation tends to be flexible. What makes the organization flexible is the way in which they organize and manage their employees, going beyond economic incentives (Teece et al., 1997) or the building of social relations (Kogut and Zander, 1992; Tsai and Ghoshal, 1998). Expanding on Burns and Stalker (1961) and Woodward (1958), Lawrence and Lorsch (1967) suggest that innovation-fostering communication and cooperation are facilitated by the different

degrees of integration and differentiation among different functions of the organization. These integrative mechanisms include the use of incentive practices whereby individuals designated as integrators are rewarded in this role. Building on Lawrence and Lorsch (1967), Galbraith (1977) suggests that a job design based on team concepts, e.g., taskforces whereby individuals are assigned to work on projects rather than individually designed tasks, also facilitates communication and cooperation. The explanation is that people tend to communicate and cooperate with people they know more than with those they do not know (Newport, 1969; Weiner, 1970). Miles and Snow (1978) argue that organizations that choose a strategy requiring continuous product innovation also need to have an organizational structure that supports this strategy. The organizational structure that facilitates product innovation is flexible with regard to how its employees are managed. Specifically, job design is less clearly defined for individuals and may be based on team concepts. Individual rewards may be based not only on individual explicit performance, but also on their group performance; they are also given some autonomy in performing their daily tasks. Other researchers discuss other organization-level elements that support technological innovation, e.g., socialization (Katz, 1997), culture as a mechanism for control in organizations (O'Reilly and Tushman, 1997), and power (Pfeffer, 1992). These all relate to how employees are managed.

Initial socialization/orientation. Ghoshal et al. (1994) and Nohria and Ghoshal (1997) studied Japanese and European firms, and found that companies use another integrative mechanism, cross-functional socialization or orientation of new employees, to encourage communication and cooperation across boundaries. The explanation is that by exposing employees to different parts of the organization, they form social ties (Tsai and Ghoshal, 1998)

that encourage communication and a sense of shared vision and cooperation. These authors suggest that these factors enable the Japanese firms to have a superior capability to mobilize and create knowledge for innovation. Other studies (e.g., Basadur, 1992) that compare the innovation processes of North American and Japanese firms also show that newly hired R&D scientists and engineers in Japanese firms are initially exposed to the sales organization, then to manufacturing, and then to other engineering organizations.

Team-based work pattern. Similar to the argument put forth by Galbraith (1977), the use of team-based work patterns in performing daily tasks enhances teamwork performance (Basadur, 1992; Ichniowski et al., 1997). Since innovation requires the use of project teams (Clark and Wheelwright, 1992), this study applies this concept to project team performance, and argues that organizations that are better at mobilizing knowledge and creating new knowledge for innovation also use team-based work patterns (Ghoshal et al., 1994). In Japanese firms, when new employees first arrive in a given department, they are not assigned a task to perform alone, but work with others in carrying out tasks (Robinson, 1996; Aoki, 1988).

Control over individuals' rewards. Katz and Allen (1985) suggest that organizations that are able to encourage knowledge sharing for innovation also grant the project managers some control over individuals' rewards. This is related to the idea of the matrix organization, whereby the control over individual reward is divided between functional and project managers. Japanese firms that are considered to have superior capability to create new knowledge for innovation (Clark and Fujimoto, 1991) also divide the control over individuals' rewards between functional and non-functional managers. In Japanese firms, both the functional and personnel managers have influence over the individual reward system. While functional managers have influence over individual performance evaluation, personnel managers have the final say in the overall

performance evaluation and reward of employees. Personnel managers decide on individual job assignment, bonus payment, and promotion. On the other hand, in American firms, functional managers exercise sole control over individuals' rewards (Milgrom and Roberts, 1992; Aoki, 1988). It is suggested that these differences between firms facilitate the capability to mobilize knowledge and new knowledge resulting in product/process innovation differently.

Individual reward structure. The way in which organizations with extensive knowledge mobilization reward employees is based partly on these behaviors (Aoki, 1988). These authors suggest that the willingness to exchange knowledge and information in Japanese firms is not determined by their cultural value systems but by the reward system that encourages these behaviors. Robinson (1996) also shows that in Japanese companies the reward system for non-management employees is not only based on individual performance but also on behavioral factors, particularly attitudes toward cooperation, and knowledge and information sharing. Moreover, the survey conducted by the Japanese Ministry of Labor (1987), analyzing the factors that companies use in rewarding employees, also shows that morale building, which is related to cooperation and knowledge sharing, is a critical factor in bonus payment and promotion.

Selection. Leonard-Barton (1992), observing a company that has the ability to mobilize knowledge for innovation and learning, finds that such an organization not only selects employees based partly on personality traits conducive to collaboration, but also rewards them based partially on team performance. Essentially, the author acknowledges that this organization has employee management practices similar to those of Japanese companies operating in Japan. Recent studies show that organizations that are effective in motivating knowledge sharing also select employees with characteristics that are conducive to cooperation and knowledge sharing (Ichniowski et al., 1997). Therefore, for knowledge mobilization, employees are either given

incentives to share their individual knowledge through communication and cooperation, or are managed such that they build social ties with other individuals in different functions to encourage communication.

Development. The development of overlapping knowledge has strong implications for cross-functional training and development of employees. Previous research also suggests that cross-functional development of employees enhances the capability to mobilize and create knowledge for innovation (e.g., Nonaka and Takeuchi, 1995), and particularly enhances the creation process. This practice differs from cross-functional orientation in that its purpose is not only to give employees exposure to these organizations, but also to assist them in acquiring knowledge and skills in these organizations in a shorter period of time than it would normally take to accomplish this. Westney and Sakakibara (1986), who compare the development of engineers in US and Japanese computer companies, show that the career paths of engineers in Japanese companies include spending an extended period of time in manufacturing and R&D organizations. US companies, however, rarely employ this practice.

INTEGRATING THE THREE PERSPECTIVES: ORGANIZATIONAL CAPABILITIES IN THE RBV, TEAM-LEVEL INNOVATION, AND ORGANIZATION-LEVEL INNOVATION

After analyzing the team-level innovation literature and organization-level innovation literature, it is still not clear how to develop the capability to mobilize and create knowledge for innovation. On one hand, the team-level innovation literature suggests that the facilitators of knowledge mobilization for innovation may be developed as needed when organized into teams for innovation. On the other hand, the organization-level innovation literature suggests that the development of these facilitators occurs at the organizational level, independent of when they are

needed for innovation. Moreover, we do not know which set of practices, the project team management practices or the organization-level management practices, is more effective in developing this capability.

In order to develop a complete model of how organizational capabilities are developed, four things are necessary. First, since the capability to mobilize knowledge is a necessary but insufficient condition for creation of new resources, we need to measure both mobilization and creation, and observe which factors facilitate each of these. Second, clarification and integration of levels and units of analyses are required. Third, we need to measure organizational capability. Fourth, we need a testable theoretical framework to understand better the process of development of organizational capability.

Linking the capability to mobilize knowledge and the capability to create knowledge for innovation

I argue that the literature on organizational capabilities tends to emphasize either knowledge mobilization (e.g., Nelson and Winter, 1982; Prahalad and Hamel, 1990; Kogut and Zander, 1992; Teece et al., 1997) or creation (e.g., Nonaka and Takeuchi, 1995; Nonaka, 1994); Leonard-Barton (1995) attempts to argue for both. Researchers who emphasize knowledge mobilization tend to assume that creation occurs, and that the critical facilitating factors involve individuals' motivation to share or mobilize their individual knowledge. For researchers who emphasize the creation process, individuals are boundedly rational, and therefore, even if the problem of motivating knowledge sharing is solved, knowledge that is being mobilized or shared does not lead to creation of new resources. Since individuals are boundedly rational, they face the problem of absorbing knowledge that is being shared and converting it into organizational knowledge, because of knowledge specialization in organization. I propose that this limitation is

solved by having individuals with the absorptive capacity for different types of knowledge that are being shared. Therefore, in developing the capability to mobilize knowledge, organizational design or management practices that motivate knowledge sharing are critical, and the conversion process requires overlapping knowledge (e.g., Nonaka and Takeuchi, 1995; Nonaka, 1994; Leonard-Barton, 1995).

Linking levels and units of analysis

The level of analysis of an organizational capability is the organization, but the project team is the key unit of analysis, since teams are mechanisms for knowledge mobilization and creation for innovation. Therefore, the two levels of analysis can be integrated in order to understand the way in which this capability is developed. By using the organization-level and team-level innovation literatures, this study attempts to integrate these two levels of analysis by suggesting that regardless of team structures used in the process of innovation, team members remain embedded in the daily context of the organization. Therefore, these teams are subject to the ongoing organization-level processes such as communication patterns, a shared sense of cooperation or commitment in achieving organizational goals, and the level of overlapping knowledge (or lack thereof) (Nonaka and Takeuchi, 1995). Staw, Sandelands, and Dutton (1981) and Morrill (1995) suggest that knowledge, skills, communication routines, and the mindset of individuals, which is acquired in the larger context of the organization from performing daily tasks, are carried over when they organize to carry out non-routine tasks, i.e. innovation. Hence, in organizations where the supporting organization-level processes are built into the organizational context, we can also expect to see similar elements of these processes on project teams; this supports the organization-level innovation literature. This suggests that in such organizations, team management practices that generate the supporting team-level processes are

probably less necessary. However, for organizations that lack these supporting organization-level processes, team management practices, such as development and reward, are necessary. These arguments suggest that there are potentially two models for developing the same thing, organizational capabilities.

Measuring organizational capabilities

Since we cannot measure organizational capability directly and indirectly using patents, the team-level innovation literature and organization-level innovation literature provide us with some measures beyond innovation. From the team-level innovation literature, we have efficiency in terms of resources used in the process of achieving innovation (Clark and Wheelwright, 1992), effectiveness in terms of speed-to-market of the innovation and customer satisfaction with the innovation (Clark and Fujimoto, 1991). From the organization-level innovation literature, we have product and process innovation as defined by Nohria and Gulati (1995) following the lead of Van de Ven (1986), and learning (Senge, 1990).

Process of developing organizational capabilities

In terms of “how” firms develop this capability, our understanding is still limited. The three bodies of literature imply two main models for developing this capability, which I refer to as the “project team” and the “organization”. The “project team” model deals with making the investment by managing employees only when they are organized for innovation such that they are motivated to share knowledge and committed to accomplishing the project. This model suggests the use of team management practices, specifically reward for team performance and team development. The “organization” model requires the investment at the organization level independent of when employees are organized to mobilize and create knowledge for innovation. They are managed such that communication patterns and a shared sense of cooperation and

commitment are fused in the organizational context, independent of when companies organize their employees for innovation. Organizations accomplish this through selection of employees not only based on individual potential output for the organization but behavioral factors conducive to knowledge sharing and/or reward not only based on their individual explicit output but also their behavioral factors. Moreover, organizations may invest in cross-functional socialization or orientation of new employees such that they are exposed to individuals in different parts of the organization, which facilitates knowledge sharing. To facilitate the knowledge creation process, individuals are developed such that they have some overlapping knowledge in different disciplines. Therefore, as the literature stands, we still do not know how to develop the capability to mobilize and create knowledge for generating new resources. Figure 1 provides a theoretical framework of how organizational capabilities are developed. Though this paper provides two models for developing the same thing, it also raises the following empirical questions: Do organizations develop these capabilities by following the organization or the project team model? Are there alternative models for developing the same capabilities? Which models are more effective and for which outcomes of capabilities?

DISCUSSION AND CONCLUSIONS

The study expands the resource-based view of the firm (RBV) by providing a theoretical framework of how firms develop the capabilities to mobilize and create knowledge for innovation. In the process it addresses the following limitations in the theory: (1) the treatment of the capability to mobilize knowledge vs. the capability to create new knowledge in the discussions of organizational capabilities as sources of competitive advantage, (2) level and unit of analysis, and (3) measurement.

One of the most critical limitations in the RBV is the lack of theoretical framework of key factors and management practices that explain how firms might invest in developing the capabilities to generate new resources, i.e. innovation (Foss, 1997; Foss et al., 1995). Fortunately, the team-level innovation and organization-level innovation literatures help to explain how the capability to mobilize and create knowledge for innovation is developed; after all, they are also about new knowledge creation and innovation, although they do not discuss their processes and outcomes in terms of capabilities. Another advantage of linking these bodies of literature to the organizational capability literature is that they provide empirical support for some of the processes and management practices that facilitate innovation. By integrating these three streams of literature we have two models for developing these capabilities. The “organization model” requires firms to make an investment at the organization level to generate the supporting organization-level processes, i.e., communication or knowledge sharing routines independent of when they are organized for innovation. The “project team model” calls for firms to make the just-in-time investment as needed in the process of innovation to generate similar supporting processes that are lacking at the organization level. The alternative models and their efficacy necessitates empirical tests.

This paper also contributes to theory by bridging the gap between the discussions of knowledge (resource) mobilization and knowledge creation, which have different implications for investment in developing capabilities. This study suggests that knowledge mobilization is a necessary but insufficient condition for knowledge creation, and the processes of mobilization and creation are supported by different factors. While mobilization deals with the motivation for knowledge sharing, the creation process deals with the idea that knowledge that is being shared is not automatically absorbed and converted into organizational knowledge without the

absorptive capacity of the recipients to do so. When knowledge that is being shared is not absorbed by the recipients, individual knowledge conversion into organizational knowledge in the form of innovation is problematic. Therefore, in order to develop this capability, facilitators of knowledge mobilization and creation are also necessary.

Moreover, the paper expands theory by dealing with the problematic issue of level and unit of analysis, which has been overlooked in other studies. It shows that organizational capability's level of analysis is the organization but project team is the unit of analysis as teams are mechanisms for knowledge mobilization and creation for innovation. Thus, the two levels of analysis can be integrated to understand how this capability is developed. I show that the organization-level and team-level can be integrated by suggesting that regardless of the team structures used in the process of innovation, team members remain embedded in their daily context of the organization, meaning that teams are subject to the ongoing organization-level processes. Thus, in organizations where the supporting organization-level processes are built into the organizational context, we might see similar elements of these processes on project teams.

Finally, this research addresses the challenge of the measurement of organizational capability. From the team-level innovation literature, we have efficiency in terms of resources used in the process of achieving a particular innovation, effectiveness in terms of speed-to-market of the innovation, and customer satisfaction with the innovation, which are also important. From the organization-level innovation literature, we have product and process innovation.

Future research

Future research should empirically address the following questions: How do organizations develop the capabilities to mobilize and create knowledge for innovation? Do

organizations develop these capabilities by following the organization or the project team model? Are there alternative models for developing the same capabilities? Which models are more effective and for which outcomes of capabilities?

In order to answer the question of “how”, comparative case method is necessary to develop an empirically ground theory (Yin, 1984) about ways in which firms invest in developing these capabilities. We may start out with an in-depth analysis of a small set of firms seeing what they do at the organization level independent of when they organize their employees into project teams to generate innovation and the supporting organization-level processes, i.e., communication or knowledge sharing routines. In the same companies, we should also observe what companies do when organized their employees into project teams to mobilize and create knowledge for innovation, i.e., team development, reward, and team membership selection. If firms employ mostly the organization-level practices and minimal at the project team level, we may classify them as following the “organization model”. On the other hand, for firms that only use project team management practices specifically when organized for innovation, they may be classified as following the “project team model”. For firms that use the combination, we consider them as following the “mixed model”.

After identifying the different models that firms use to develop these capabilities, we can conduct empirical tests to answer questions about the efficacy of these models. A large sample of companies possibly in the same industry is necessary. However, in order to have an adequate sample size, companies in the same sector, i.e., manufacturing may have to be selected, though proper control of alternative explanations is necessary. Although the level of analysis is still the organization the unit of analysis is the project team consisting of individuals from different parts of the organization coming together to share and create knowledge for innovation.

REFERENCES

- Allen, T. 1977. *Managing the flow of technology*. Cambridge, MA: MIT Press.
- Ancona, D., and Caldwell, D. 1999. *Compose teams to assure successful boundary activity*. Working paper no. 4097, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.
- Ancona, D., and Caldwell, D. 1992a. Demography and design: Predictors of new product team performance. *Organization Science*, 3: 321-341.
- Aoki, M. 1988. *Information, incentives, and bargaining in the Japanese economy*. Cambridge: Cambridge University Press.
- Bain, J. S. 1956. *Barriers to new competition*. Cambridge, MA: Harvard University Press.
- Barnard, C. 1938. *The Functions of executive*. Cambridge, MA: Harvard University Press.
- Barney, J. B. 1991. Firm resources and sustained competitive advantage. *Journal of Management*, 17: 99-120.
- Barney, J. B. 1986. Strategic factor markets: Expectations, luck and business strategy. *Management Science*, 42: 1231-1241.
- Basadur, M. 1992. Managing creativity: A Japanese model. *Academy of Management Executive*, 6: 29-40.
- Baumol, W., Panzar, J., and Willig, R. D. 1987. *Contestable markets and the theory of industry structure*. New York, NY: Hartcourt Brace Jovanovich.
- Boland, R., and Tenkasi, R. 1995. Perspective making and perspective taking in communities of knowing. *Organization Science*, 6: 350-373.
- Brown, J. S., and Duguid, P. 1991. Organizational learning and communities-of-practice. *Organization Science*, 1: 40-57.
- Brown, S., and Eisenhardt, K. 1997. The art of continuous change: Linking complexity theory and time-paced evolution in relentlessly shifting organizations. *Administrative Science Quarterly*, 42: 1-34.

- Brown, S., and Eisenhardt, K. 1995. Product development: Past research, present findings, and future directions. *Academy of Management Review*, 20(2): 343-378.
- Burns, T., and Stalker, G. M. 1961. *The management of innovation*. London, England: Tavistock.
- Cannon-Bowers J. A., Salas, E. Converse, S. A. 1990. Cognitive Psychology and Team Training: Shared mental model in complex systems. *Human Factors Bulletin*, 33: 1-4.
- Clark, K. and Fujimoto, T. 1991. *Product development performance: Strategy, organization, and management in the world auto industry*. Boston, MA: Harvard Business School Press.
- Clark, K., and Wheelwright, S. 1992. Organizing and leading "heavyweight" development teams. *California Management Review*, 34:9-28.
- Cyert, R. M. and March, J. G. 1963. *A behavioral theory of the firm*. Englewood Cliffs, NJ: Prentice-Hall.
- Denison, D. R., Hart, S. L., and Kahn, J. A. 1996. From chimneys to cross-functional teams: Developing and validating a diagnostic model. *Academy of Management Journal*, 39(4): 1005-1023.
- Dougherty, D. 1987. *New products in old organizations: The myth of the better mousetrap in search of the beaten path*. Unpublished doctoral dissertation. Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.
- Dougherty, D. 1992. Interpretative barriers to successful product innovation in established firms. *Organization Science*, 3: 179-202.
- Foss, N. J. 1997. Resources and strategy: A brief overview of themes and contributions. In Foss, N. J. (Ed.), *Resources, firms and strategies: A reader in the resource-based perspective*. Oxford, UK: Oxford University Press.
- Foss, N. J., Knudsen, C. and Montgomery, C. A. 1995. An Exploration of common ground: integrating evolutionary and strategic theories of the firm. In C. A. Montgomery (Ed.), *Resource-based and evolutionary theories of the firm: towards a synthesis*. Boston, MA: Kluwer Academic Publishers.
- Galbraith, K. 1977. *Organization design*. Reading, MA, Addison-Wesley Publishing Company.

- Ghoshal, S., Korine, H., and Zsulanski, G. 1994. Interunit communication in multinational corporations. *Management Science*, 40: 96-110.
- Gladstein, D. 1984. Groups in context: A model of task group effectiveness. *Administrative Science Quarterly*, 29: 499-517.
- Godfrey, P. C., and Hill, C. W. L. 1995. The problem of unobservables in strategic management research. *Strategic Management Journal*, 16: 519-533.
- Grant, R. 1996. Toward a knowledge-based theory of the firm. *Strategic Management Journal*, 17: 109-122.
- Griffin, A., and Hauser, J. 1992. Patterns of communications among marketing, engineering and manufacturing – A comparison between two new product development teams. *Management Science*, 38: 360-373.
- Grilliches, Z. 1984. *R&D, patents and productivity*. Chicago, IL: University of Chicago Press.
- Hackman, J. R. 1987. The design of work teams. In Jay W. Lorsch (Ed.), *Handbook of Organizational Behavior*. Englewood Cliffs, NJ: Prentice-Hall.
- Hackman, J. R. 2000. Rethinking Group Leadership: Evidence from Airplanes, Orchestras, and Hospitals. *Presentation at MIT Sloan School of Management*, Cambridge, MA.
- Hamel, G. 1994. *Competence-based competition*. Chichester, UK: Wiley.
- Helfat, C. E., and Raubitschek, R. S. 2000. Product sequencing: Co-evolution of knowledge, capabilities and products. *Strategic Management Journal*, 21(10-11): 961-980.
- Henderson, R., and Cockburn, I. 1994. Measuring competence? Exploring firm effects in pharmaceutical research. *Strategic Management Journal*, 15: 63-75.
- Hershock, R., Cowman, C., and Peters, D. 1994. From experience: Action teams that work. *Journal of Product Innovation Management*, 11, 95-104.
- Ichniowski, C., Shaw, K., and Prennushi, G. 1997. The effects of human resource management practices on productivity: A study of steel finishing lines. *American Economic Review*, 87: 291-313.

Japanese Ministry of Labor. 1987. *Rosei Jiho* No. 2973 and No. 2853.

Katz, R. 1997. Organizational socialization. In R. Katz (ed.), *The human side of managing technological innovation: A collection of readings*. Oxford, England: Oxford University Press.

Katz, R., and Allen, T. 1985. Project performance and the locus of influence in the R&D matrix. *Academy of Management Journal*, 28: 67-87.

Katz, R., and Allen, T. 1982. Investigating the not invented here (NIH) syndrome: A look at the performance, tenure, and communication patterns of 50 R&D project groups. *R & D Management*, 12: 7-19.

Katz, D. and Kahn, R. L. 1966. *The social psychology of organizations*. New York, NY: John Wiley & Sons, Inc.

Klimoski, R., and Mohammed, S. 1994. Team mental model: Construct or metaphor? *Journal of Management*, 20: 403-37.

Kogut, B., and Zander, U. 1992. Knowledge of the firm, combinative capabilities and the replication of technology. *Organization Science*, 3: 383-97.

Lawler, E. 1994. *Motivation in work organizations*. San Francisco, CA: Jossey-Bass Publishers.

Lawrence, P. R., and Lorsch, J. W. 1967. *Organization and environment: Managing differentiation and integration*. Boston, MA: Division of Research, Graduate School of Business Administration, Harvard University.

Leonard-Barton, D. 1992. The factory as a learning laboratory. *Sloan Management Review*, 34: 23-38.

Leonard-Barton, D. 1995. *Wellsprings of knowledge*. Boston, MA: Harvard Business School Press.

Leonard, D. and Sensiper, S. 1998. The role of tacit knowledge in group innovation. *California Management Review*, 40: 112-132.

Liebesskind, J. P. 1996. Knowledge, strategy and theory of the firm. *Strategic Management Journal*, 17: 93-107.

- Lincoln, J. R., and Kalleberg, A. L. 1990. *Culture, control, and commitment: a study of work organization and work attitudes in the United States and Japan*. Cambridge, UK: Cambridge University Press.
- Lincoln, J. R., and Kalleberg, A. L. 1996. Commitment, quits, and work organization in Japanese and U.S. plants. *Industrial & Labor Relations Review*, 50: 39-60.
- Madhavan, R., and Grover, R. 1998. From embedded knowledge to embodied knowledge: New product development as knowledge management. *Journal of Marketing*, 62: 1-12.
- Miles, R., and Snow, C. 1978. *Strategy, structure, processes, and performance*. New York, NY: McGraw-Hill Book Company.
- Milgrom, P., and Roberts, J. 1992. *Economics, organization and management*. Englewood Cliffs, NJ: Prentice Hall.
- Morrill, C. 1995. *The executive way*. Chicago, IL: University of Chicago Press.
- Nelson, R. R., and Winter, S. G. 1982. *An evolutionary theory of economic change*. Cambridge, MA: Harvard University Press.
- Newport, W. M. 1969. *The interdepartmental transfer: An integrative strategy*. Unpublished MA dissertation, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.
- Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. *Organization Science*, 5: 14-37.
- Nonaka, I., and Takeuchi, H. 1995. *The knowledge-creating company: How Japanese create the dynamics of innovation*. Oxford, UK: Oxford University Press.
- Nohria, N., and Ghoshal, S. 1997. *The differentiated network*. San Francisco, CA: Jossey-Bass Publishers.
- Nohria, N., and Gulati, R. 1995. What is the optimum amount of organizational slack? A study of the relationship between slack and innovation in multinational firms. *Academy of Management Best Papers Proceedings*: 32-36.
- O'Reilly, C., and Tushman, M. L. 1997. Using culture for strategic advantage: Promoting innovation through social control. In M. L. Tushman and P. Anderson (eds.), *Managing*

strategic innovation and change: A collection of readings. Oxford, UK: Oxford University Press.

Ouchi, W. 1979. *Markets, bureaucracy and clans*. Mimeo, Graduate School of Management, University of California at Los Angeles, Los Angeles, CA.

Penrose, E. 1959. *The theory of the growth of the firm*. New York, NY: John Wiley.

Peteraf, M. 1993. The cornerstones of competitive advantage: A resource-based view. *Strategic Management Journal*, 14: 179-191.

Pfeffer, J. 1992. Managing with power: Politics and influences in organizations. *California Management Review*, 34(2): 29-51.

Prahalad, C. K., and Hamel, G. 1990. The core competence of the corporation. *Harvard Business Review* (May-June): 79-91.

Roberts, E., and Fufeld, A. 1982. Critical functions: Needed roles in the Innovation Process. In R. Katz (Ed.), *Career Issues in Human Resource Management*. Englewood Cliffs, NJ: Prentice Hall, Inc.

Robinson, P. A. 1996. *Applying institutional theory to the study of the multinational enterprise: Parental control and isomorphism among personnel practices in American manufacturers in Japan*. Unpublished doctoral dissertation, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

Roth, G. L., and Kleiner, A. 1996. *The Learning initiative at the Auto Company Epsilon Program*. Working paper 18.005, Organizational Learning Center, Massachusetts Institute of Technology, Cambridge, MA.

Rumelt, R. 1982. Diversification strategy and profitability. *Strategic Management Journal*, 3: 359-369.

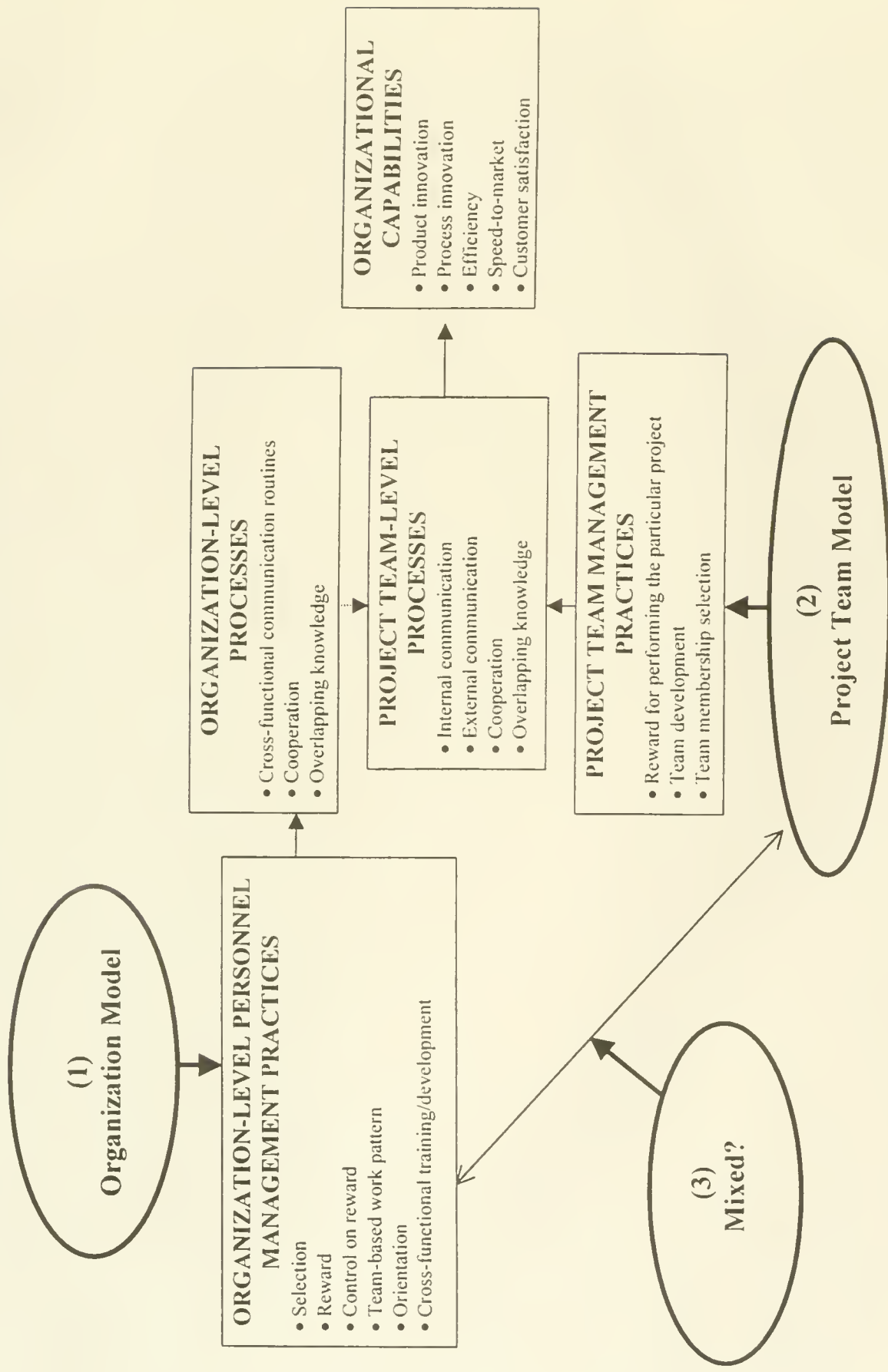
Schein, E. 1996. *Three cultures of management: The key to organizational learning in the 21st century*. Mimeo, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.

Schumpeter, J. A. 1934. *The theory of economic development*. New York, NY: Harger and Brothers.

- Senge, P. 1990. *The fifth discipline*. New York, NY: Doubleday.
- Spence, A. M. 1981. The learning curve and competition. *Bell Journal of Economics*, 12: 49-70.
- Spencer, J. C. 1996. Making knowledge the basis of the dynamic theory of the firm. *Strategic Management Journal*, 17: 45-62.
- Souder, W. E. 1987. *Managing new product innovations*. Lexington, MA: Lexington Books.
- Staw, B., Sandelands, L., and Dutton, J. 1981. Threat-rigidity effects in organizational behavior: A multilevel analysis. *Administrative Science Quarterly*, 26: 501-524.
- Stigler, G. 1968. *The organization of industry*. Chicago, IL: Chicago University Press.
- Teece, D. J., Pisano, G., and Shuen, A. 1997. Dynamic capabilities and strategic management. *Strategic Management Journal*, 7: 509-533.
- Thamhain, H. J., and Wilemon, D. L. 1997. Building high performing engineering project teams. In R. Katz (ed.), *The Human Side of Managing Technological Innovation*. Oxford, UK: Oxford University Press.
- Tsai, W., and Ghoshal, S. 1998. Social capital and value creation: The role of intrafirm networks. *Academy of Management Journal*, 41: 464-476.
- Tushman, M. L. 1977. Special boundary roles in the innovation process. *Administrative Science Quarterly*, 22: 587-605.
- Tushman, M. L. 1979. Work characteristics and solo unit communication structure: A contingency analysis. *Administrative Science Quarterly*, 24: 82-98.
- Tushman, M. L., and Anderson, P. 1997. Preface. In M. L. Tushman and P. Anderson (eds.), *Managing strategic innovation and change: A collection of readings*. Oxford, UK: Oxford University Press.
- Van de Ven, A. H. 1986. Central problems in the management of innovation. *Management Science*, 32: 590-607.
- Wageman, R. 1995. Interdependence and group effectiveness. *Administrative Science Quarterly*, 40: 145-180.

- Wageman, R., and Baker, G. 1997. Incentives and cooperation: The joint effects of task and reward interdependence on group performance. *Journal of Organizational Behavior*, 18: 139-158.
- Weick, K. E. 1995. *Sense making in organizations*. Thousand Oaks: NJ: Sage Publications.
- Weiner, H. 1970. *Role perception and organization ineffectiveness in the foreign service*. Unpublished MA dissertation, Sloan School of Management, Massachusetts Institute of Technology, Cambridge, MA.
- Wernerfelt, B. 1997. Forward. In N. Foss (Ed.), *Resources firms and strategies: A reader in the resource-based perspective*. Oxford, UK: Oxford University Press.
- Wernerfelt, B. 1984. A Resource-based view of the firm. *Strategic Management Journal*, 5: 171-180.
- Westney, D. E., and Sakakibara, K. 1986. Designing the designers: Computer R&D in the United States and Japan. *Technology Review*, 89(3): 24-31.
- Winter, S. G. 2000. The satisficing principle in capability learning. *Strategic Management Journal*, 21(10-11): 981-996.
- Winter, S. 1995. Four Rs of Profitability: Rents, resources, routines, and replication. In C. A. Montgomery (Ed.), *Resource-based and evolutionary theories of the firm: Towards a synthesis*. Boston, MA: Kluwer Academic Publishers.
- Woodward, J. 1958. *Management and technology*. Oxford, UK: Oxford University Press.
- Yin, R. 1984. *Case study research: Design and methods*. Beverly Hills, Calif.: Sage Publications.

Figure 1. Framework for developing the capability to mobilize and create knowledge for innovation



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